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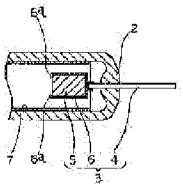
(21)Application number : 09-233762 (71)Applicant : HARISON ELECTRIC CO LTD

(22)Date of filing : 29.08.1997 (72)Inventor : UENO TAKASHI

(54) LOW-PRESSURE DISCHARGE LAMP AND LIGHTING SYSTEM



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a lamp with long life in which a desired emitting characteristic or starting characteristic can be provided, even if the bulb

diameter is reduced by providing a glass tube bulb, a sintered electrode containing an electron-emitting material which is provided on the end part thereof, and a rare gas sealed in the bulb.

SOLUTION: In a sintered electrode 5, cathode drop voltage is reduced, and lamp voltage and power consumption can be reduced to improved the emitting efficiency and starting characteristic, since the wear of an electron-emitting material contained therein is gradually transferred from the surface side of the sintered electrode 5 according to the lighting of a lamp, and the electron emitting material is held therein in large quantities. Thus, a fluorescent lamp of high efficiency and extended in life, even through use in a heavy current area can be provided. Further, since a rare gas is sealed in the bulb, the heat insulating property of the electrode 5 in lighting can be enhanced to minimize heat loss, the efficiency of thermion emission from the electrode 5 can be enhanced, and the sputtering of the electrode 5 member can also be suppressed.

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CLAIMS

[Claim(s)]

[Claim 1] The low-pressure discharge lamp characterized by providing a glass tube bulb, the sintered electrode containing the electron emission nature matter prepared in the edge of this bulb, and the rare gas enclosed in the above-mentioned bulb.

[Claim 2] The low-pressure discharge lamp characterized by providing a glass tube bulb, the sintered electrode containing the electron emission nature matter prepared in the edge of this bulb, the fluorescent substance film formed in the above-mentioned bulb front face, and the rare gas containing Xe enclosed in the above-mentioned bulb.

[Claim 3] A sintered electrode is a low-pressure discharge lamp according to claim 1 or 2 characterized by being porosity-like.

[Claim 4] At least a kind of refractory metal with which the sintered electrode was chosen from from among Nb, Mo, Ru, Hf, Ta, W, Re, and Os, The low-pressure discharge lamp according to claim 1 to 3 characterized by having the metal which has a kind of reduction [at least] operation by which it was chosen out of from

among Mg, aluminum, Si, and Zr, and the oxide of at least a kind of alkaline earth metal chosen from from among calcium, Sr, Ba, and Ra.

[Claim 5] At least a kind of refractory metal with which the sintered electrode was chosen from from among Nb, Mo, Ru, Hf, Ta, W, Re, and Os, The metal which has a kind of reduction [at least] operation by which it was chosen out of from among Mg, aluminum, Si, and Zr, The low-pressure discharge lamp according to claim 1 to 3 characterized by having the oxide of at least a kind of alkaline earth metal chosen from from among calcium, Sr, Ba, and Ra, and a ceramic formation ingredient.

[Claim 6] The lighting system characterized by providing the body of an instrument, the low-pressure discharge lamp according to claim 1 to 5 prepared in this body of an instrument, and the burning circuit apparatus connected to this low-pressure discharge lamp.

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to lighting systems, such as back

light equipment of the above-mentioned information machines and equipment equipped with the low-pressure discharge lamp used in a display device or lighting fitting, such as information machines and equipment, such as a personal computer, and television, etc., and this lamp, or a display device, and lighting fitting.

[0002]

[Description of the Prior Art] Rare gas, such as an argon, and the mercury of optimum dose are enclosed as a discharge medium for the configuration of a low-pressure discharge lamp, for example, a fluorescent lamp, to make discharge easy into this bulb, and carry out predetermined luminescence while a discharge electrode is prepared in the ends of the glass tube bulb by which the fluorescent substance coat was formed in the inner surface.

[0003] And this fluorescent lamp passes a current to an electrode, makes discharge occur in a bulb, excites the fluorescent substance which generates ultraviolet rays and is applied to the bulb inner surface, and emits the colored light of requests, such as white, daylight color, blue, and red, from a lamp according to the class of fluorescent substance.

[0004] In recent years, the fluorescent lamp is used as a back light of display devices, such as information machines and equipment, such as a personal computer incorporating liquid crystal besides for [usual] lighting, a word processor, and an electronic notebook, and television.

[0005] And this fluorescent lamp has a small input, compared with the fluorescent lamp for the usual general lighting, it is miniaturized with a narrow diameter, and it is a low power and high performance-ization of a raise in brightness, thin-shape-izing, a miniaturization, power-saving, reinforcement, etc. is recommended simultaneously.

[0006] On the other hand, that to which it is a principle to which that lamp replacement is not performed and the lamp also set these devices by the life of a device is demanded. For this reason, the design of the optimal electrode is made also from a viewpoint of a life with the current, the class of an electrical potential

difference and rare gas to enclose, the amount of mercury, etc. so that the small fluorescent lamp for back lights may suit a low power.

[0007] Thus, in order to miniaturize a lamp, the coiled form filament electrode which also needed to miniaturize the polar zone and wound the tungsten wire in property is desirable, but while a narrow diameter filament is difficult to support, the problem of being weak is in an oscillation or an impact. A bulb is replaced with a filament electrode with the narrow-diameter-ized discharge lamp 10mm or less, and the electrode of a cold cathode mold is used abundantly there. In order to use what made the shape of plate-like [made from nickel plate], and a cylinder, the shape of a character of **, and the shape of a cylinder made from nickel, and for this cold cathode type of electrode to raise bleedoff of a thermoelectron to the front face of these electrodes and to acquire a life over a long period of time, spreading formation of the electron emission nature matter (emitter) which consists of an oxide of alkaline earth metal, such as Ba, is carried out. And if it exhausts gradually and the electron emission nature matter is drained with burning progress, burning of it will become impossible and it will result in a life.

[0008] However, constitutionally, since only the front face held the electron emission nature matter, the amount of the above-mentioned electrode was not enough, and it had the thing of the part exfoliating and dropping out of an electrode with an oscillation, an impact, etc. Moreover, since a high increase in power is carried out, while electrodes, such as the shape of tabular or a cylinder, have small surface area, a package cathode drop electrical potential difference rises [discharge] the whole electrode, lamp voltage becomes high and luminous efficiency falls, consumption of an electrode configuration member sometimes already serves as [small and / sputtering] a **** life intense recently. And these phenomena had become a failure when recommending high performance-ization of thin-shape-izing of the back light equipment of information machines and equipment or a display device etc., a miniaturization, power-saving, a raise in brightness, reinforcement, etc.

[0009]

[Problem(s) to be Solved by the Invention] Even if this invention was made in view of the above-mentioned problem and narrow-diameter-izes the diameter of a glass tube bulb, it aims at offering lighting systems, such as back light equipment equipped with the long lasting low-pressure discharge lamp with which a desired luminescence property and the desired starting characteristic are acquired, and this lamp.

[0010]

[Means for Solving the Problem] The low-pressure discharge lamp of this invention according to claim 1 is characterized by providing a glass tube bulb, the sintered electrode containing the electron emission nature matter prepared in the edge of this bulb, and the rare gas enclosed in the above-mentioned bulb.

[0011] An electrode is formed with a sintered compact and the abundant maintenance of the electron emission nature matter can be carried out even inside an electrode. And since the electron emission nature matter is gradually exhausted toward the interior of an electrode from the front-face side with burning progress of a lamp, it can continue and continue at a long period of time, namely, the reinforcement of the discharge can be carried out. Moreover, since the electron emission nature matter is held so much, a cathode drop electrical potential difference can become low, lowering of lamp voltage and power consumption can be aimed at, and luminous efficiency and the starting characteristic can be improved.

[0012] The low-pressure discharge lamp of this invention according to claim 2 is characterized by providing a glass tube bulb, the sintered electrode containing the electron emission nature matter prepared in the edge of this bulb, the fluorescent substance film formed in the above-mentioned bulb front face, and the rare gas containing Xe enclosed in the above-mentioned bulb.

[0013] In the fluorescent lamp which a fluorescent substance is excited [fluorescent lamp] and makes it emit light, a publication and the same operation are done so to above-mentioned claim 1.

[0014] Moreover, below 150Torr(s) (20kPa) is carrying out pressure enclosure of the rare gas containing Xe (xenon), and since it is comparatively small compared with Ar (argon) etc., the heat retaining property of an electrode has good thermal conductivity, and this Xe has little heat loss of an electrode, and can make effectiveness of thermionic emission high. Moreover, sputtering of an electrode member can also be controlled. In addition, the rate of Xe in enclosure rare gas (xenon) should just be the range of 60 - 100 capacity %. In addition, with the lamp which enclosed Ar (argon) as a subject, the heat retaining property of an electrode may be bad, it may be difficult to maintain the luminescent spot on the surface of an electrode in a low current field, and consumption of an electrode member may become a short life quickly by sputtering.

[0015] The low-pressure discharge lamp of this invention according to claim 3 is characterized by a sintered electrode being porosity-like.

[0016] An electrode is formed with the sintered compact of a metal and the electron emission nature matter (oxide of alkaline earth metal), and the abundant maintenance of the electron emission nature matter can be carried out even inside an electrode in the shape of porosity. And the same operation is done so with a publication to above-mentioned claim 1.

[0017] The low-pressure discharge lamp of this invention according to claim 4 is characterized by having a kind of refractory metal with which the sintered electrode was chosen from from among Nb, Mo, Ru, Hf, Ta, W, Re, and Os, the metal which has a kind of reduction [at least] operation by which it was chosen out of from among Mg, aluminum, Si, and Zr, and the oxide of at least a kind of alkaline earth metal chosen from from among calcium, Sr, Ba, and Ra at least.

[0018] Since the alkaline earth metal which has an electron emission operation is an oxide, for the ** reason to which this is dissociated and activation of the electron emission nature matter is urged, the metal which the refractory metal in a sintered electrode is the base ingredient of an electrode, it is used in order to maintain the resistance over the evaporation reduction and sputtering of an electrode, and has a reduction operation is mixed.

[0019] In addition, the oxide of a refractory metal, the metal which has a reduction operation, and alkaline earth metal should just contain a kind chosen from each group thru/or two or more sorts.

[0020] The low-pressure discharge lamp of this invention according to claim 5 At least a kind of refractory metal with which the sintered electrode was chosen from from among Nb, Mo, Ru, Hf, Ta, W, Re, and Os, The metal which has a kind of reduction [at least] operation by which it was chosen out of from among Mg, aluminum, Si, and Zr, The low-pressure discharge lamp according to claim 1 or 2 characterized by having the oxide of at least a kind of alkaline earth metal chosen from from among calcium, Sr, Ba, and Ra, and a ceramic formation ingredient.

[0021] By mixing at least a kind of ceramic formation ingredient which was chosen as above-mentioned claim 4 from oxides, such as aluminum, Si, Mg, Be, Y, Hf, Zr, and Th, etc. in addition to the ingredient of a publication, sintering, and considering as ceramic-ization, a sintered electrode lowers own thermal conductivity of an electrode, and does so the operation which raises heat retaining property.

[0022] In addition, the oxide and ceramic formation ingredient of a refractory metal, the metal which has a reduction operation, and alkaline earth metal should just contain a kind chosen from each group thru/or two or more sorts.

[0023] The lighting system of this invention according to claim 6 is characterized by providing the body of an instrument, the low-pressure discharge lamp according to claim 1 to 5 prepared in this body of an instrument, and the burning circuit apparatus connected to this discharge lamp.

[0024] Since this lighting system is equipped with the low-pressure discharge lamp which has above-mentioned claim 1 thru/or an operation according to claim 5, it can achieve the reinforcement of ****** of various devices, such as a back light.

[0025]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention

is explained with reference to drawing 1 thru/or drawing 3 . drawing 1 -- some low-pressure discharge lamps -- it is the cross-sectional view which a notching front view and drawing 2 met the enlarged vertical longitudinal sectional view of the edge of the lamp of drawing 1 , and drawing 3 met the view A-A line of drawing 1 , and carried out the cross section.

[0026] As for this low-pressure discharge lamp, sealing of the lead wire 4 with which about 0.5mm and an overall length are [about 4.8mm and thickness] about 400mm for an outer diameter, and the tubing-like bulb 1 by which the lamp current of a straight pipe form is 30mA or less fluorescent lamp L, and consists of soft glass or hard glass constitutes mounting 3 in each closure section 2 and 2 of ends is carried out airtightly.

[0027] This mounting 3 is equipped with the pipe 6 made from nickel (nickel) which carried out hold maintenance of the sintered electrode 5 and this sintered electrode 5 of the shape of a cylinder which carried out mixed sintering of a metal and the electron emission nature matter (emitter) at the head of lead wire 4 in the bulb 1. And the diameter of the end side of this pipe 6 was reduced, and it inserted the head of the above-mentioned lead wire 4, and carried out welding immobilization, and the other end side has prevented omission of a sintered electrode 5 by the stop pieces 6a and 6a which bent the part to the inner direction. Moreover, this sintered electrode 5 consists of what mixed and sintered the refractory metal which consists of Ta (tantalum), the metal which has the reduction operation which consists of Zr (zirconium), and the alkaline earth metal which consists of Ba (barium) as electron emission nature matter.

[0028] The presentation ingredient of this sintered electrode 5 as a refractory metal group In addition, Nb (niobium), Mo (molybdenum), Ru (ruthenium), Hf (hafnium), Ta (tantalum), W (tungsten), Re (rhenium), Os (osmium), etc. As a metal group which has a reduction operation, moreover, Mg (magnesium), aluminum (aluminum), Si (silicon), Zr (zirconium), etc. -- moreover -- as the electron emission nature matter (emitter) -- calcium (calcium) of an alkaline-earth-metal group -- What is necessary is for there to be Sr (strontium), Ba

(barium), Ra (radium), etc., and to choose at least one sort from each [these] groups, and just to carry out a mixed configuration.

[0029] Moreover, the fluorescent substance coat 7 of the three-wave form which mixed the fluorescent substance which has a luminescence field in blue, green, and red is formed in the internal surface of the above-mentioned bulb 1, and about 100 Torr enclosure of the mixed rare gas of Xe (xenon) about 90 volume %-helium (helium) about 10 volume % has been carried out inside the bulb 1.

[0030] If such fluorescent lamp L of a configuration is connected and energized in the usual RF burning circuit, the electron emission nature matter intermingled on the head front face of a sintered electrode 5 will carry out electron emission, and discharge will be caused between two electrodes 5 and 5. And rare gas, such as Xe, emits light, ultraviolet rays are emitted, the fluorescent substance coat 7 of bulb 1 internal surface receives these ultraviolet rays, they are excited, and the predetermined light is emitted out of a bulb 1.

[0031] This fluorescent lamp L is equipped with the sintered electrode 5 of the above-mentioned presentation, and this electrode 5 is intermingled so much in the electron emission nature matter which has the shape of porosity which mixed the fine particles of a metal and the electron emission nature matter, carried out pressing, was heat-treated, and has many openings, and consists of an oxide of Ba into that front face and an electrode 5. And even if what [not only] exists in the electrode surface but the thing located in an electrode surface side is lost, as a result of being supplied from the interior of an electrode, consumption of the electron emission nature matter can be continued and maintained at a long period of time, namely, can carry out reinforcement of the discharge.

[0032] Therefore, since consumption of the electron emission nature matter shifts to the interior gradually from the front-face side of an electrode 5 with burning progress of Lamp L and moreover holds the electron emission nature matter so much, a cathode drop electrical potential difference can become low, and the sintered electrode 5 containing the electron emission nature matter can aim at

lowering of lamp voltage and power consumption, and can improve luminous efficiency and the starting characteristic. Moreover, reduction of the cathode drop electrical potential difference of an electrode 5 will be maintained, and a well head and fluorescent lamp L which carried out reinforcement were obtained also in the activity of a high current field. Moreover, sputtering of electrode 5 member decreased and it became an aid of reinforcement.

[0033] Moreover, when this fluorescent lamp L enclosed the rare gas containing Xe in the bulb 1, as a result of raising the heat retaining property of the electrode 5 under lamp L burning, there was little heat loss in an electrode 5, and it could raise the effectiveness of the thermionic emission from an electrode 5, and control of sputtering of electrode 5 member was also attained.

[0034] Moreover, this invention may be not only the sintered electrode 5 that consists of a presentation ingredient indicated in the gestalt of the above-mentioned implementation but as follows.

[0035] At least one sort of refractory metals chosen from from among the presentation ingredients of the sintered electrode indicated in the gestalt of the above-mentioned implementation, i.e., Nb, Mo, Ru, Hf, Ta, W, Re, Os, etc., The metal which has at least one sort of reduction operations chosen from from among Mg, aluminum, Si, Zr, etc., To the oxide (electron emission nature matter) of at least one sort of alkaline earth metal chosen from from among calcium, Sr, Ba, Ra, etc. Furthermore, aluminum (aluminum), Si (silicon), Mg (magnesium), You may be the thing of the ceramic system which added at least a kind of ceramic formation ingredient chosen from from among oxides, such as Be (beryllium), Y (yttrium), Hf (hafnium), Zr (zirconium), and Th (thorium), etc., carried out mixed sintering and formed these. Thus, the ceramic-ized electrode also presents the same operation effectiveness with having indicated in the gestalt of the above-mentioned implementation.

[0036] And as shown in drawing 4 , the nest rare activity of the fluorescent lamp L shown in above-mentioned drawing 1 is carried out as the light source of back light equipment 8. A miniaturization is also possible while the reflecting mirror

with which 81 equipped with Lamps L and L and --, and 82 can achieve efficient-ization of these equipments in this drawing 4 from the place where it is used at as back light equipment of the display board with which it is the optical diffusion plate laid in opening of a reflecting mirror 81, and the predetermined display unit was formed as back light equipment of liquid crystal displays, such as a personal computer and television, and Lamp L becomes efficient.

[0037] Moreover, it can be used also as a usual lighting system.

[0038] In addition, this invention is not limited to the gestalt of the above-mentioned implementation. For example, a discharge lamp is applicable to low-pressure discharge lamps of other capillary forms (a discharge way is a small cross section), such as not only a fluorescent lamp but a lamp by rare-gas luminescence. Moreover, not only the object for back light equipments but the object for lighting can also apply the application to the lamp for ultraviolet radiation, such as sterilization, etc. from the first.

[0039] Moreover, you may make it connect an electrode and lead wire directly, without the supporting structure of a sintered electrode also using not only the gestalt of operation but a pipe etc.

[0040] Moreover, the construction material of a bulb may be hard glass, such as soft glass, such as lead glass and soda lime glass, or alumino silicate glass, and the configuration may be the bulb which connected two or more things of the shape of the crooked bulb or a straight pipe, such as not only the thing of a straight pipe configuration but a U character configuration, and a W character configuration, and formed the discharge way in serial. Furthermore, the rare gas enclosed with a lamp may be gas which mixed Ar (argon), Ne (neon), Kr (krypton), etc. not only to Xe(xenon)-helium (helium) but to Xe (xenon), and this is also doubled with a lamp property and should just determine a mixing ratio and charged pressure suitably.

[0041]

[Effect of the Invention] According to the publication of claim 1 of this invention thru/or claim 5, the low-pressure discharge lamp which was able to achieve the

improvement in luminous efficiency and reinforcement can be offered.

[0042] Since above-mentioned claim 1 thru/or claim 5 are equipped with the low-pressure discharge lamp which does so the same effectiveness as a publication according to the publication of claim 6 of this invention, the lighting system which can achieve efficient-izing and reinforcement of various devices, such as back light equipment, can be offered.

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] the gestalt of operation of the low-pressure discharge lamp of this invention is shown -- it is a notching front view a part.

[Drawing 2] It is the enlarged vertical longitudinal sectional view of the edge of the lamp of drawing 1 .

[Drawing 3] It is the cross-sectional view which carried out the cross section along with the view A-A line of drawing 1 .

[Drawing 4] It is the decomposition perspective view showing the gestalt of operation of the back light equipment concerning this invention.

[Description of Notations]

L: Fluorescent lamp (low-pressure discharge lamp)

1: Glass tube bulb

2: Closure section

3: Mounting

4: Lead wire

5: Sintered electrode

8: Back light equipment (lighting system)

81: Reflecting mirror

82: Optical diffusion plate

[Translation done.]

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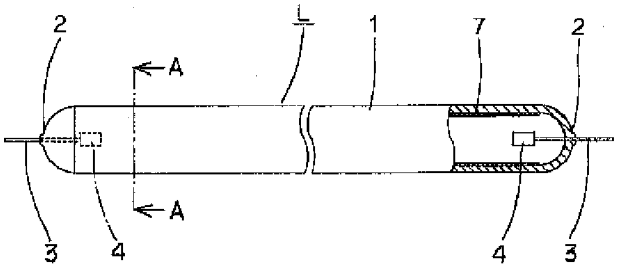
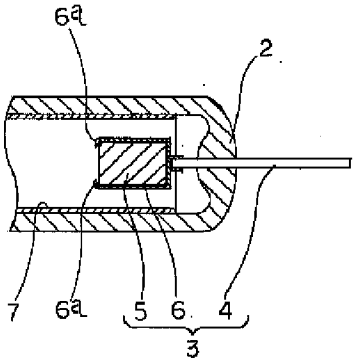
DRAWINGS

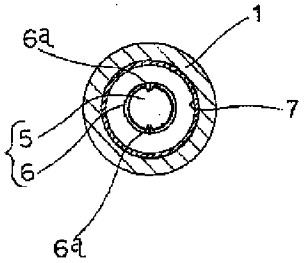
[Drawing 1]



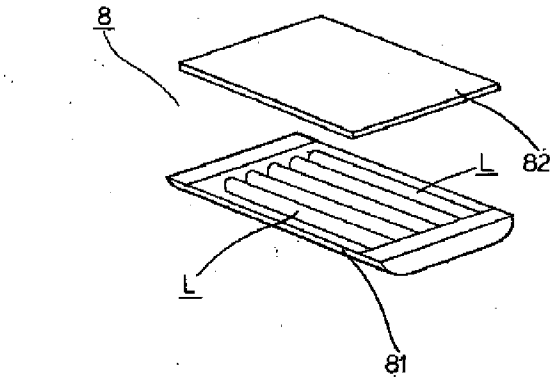
[Drawing 2]



[Drawing 3]



[Drawing 4]



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// Ｂ２２Ｆ　5/00		Ｂ２２Ｆ　5/00	Ｊ

審査請求　未請求　請求項の数６　ＯＬ　（全　５　頁）

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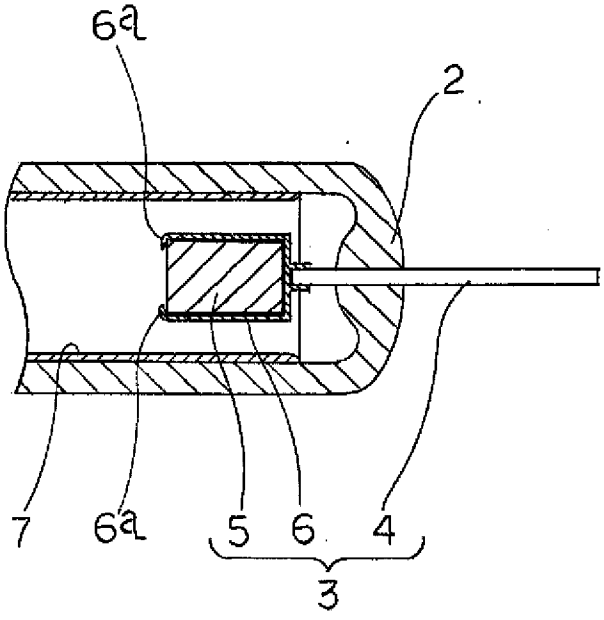
(54)【発明の名称】　低圧放電ランプおよび照明装置

(57)【要約】

【課題】　ガラス管バルブ径を細径化しても、所望の発光特性や始動特性が得られる長寿命の低圧放電ランプおよびこのランプを装着したバックライト装置などの照明装置を提供することを目的とする。

【解決手段】　ガラス管バルブ１と、このバルブ１の端部に設けられた電子放射性物質を含有する焼結電極５と、上記バルブ１内に封入された希ガスとを備えた冷陰極放電ランプＬおよびこの放電ランプＬを装着した照明装置８である。



【特許請求の範囲】
【請求項１】　ガラス管バルブと、このバルブの端部に設けられた電子放射性物質を含有する焼結電極と、上記バルブ内に封入された希ガスとを具備していることを特徴とする低圧放電ランプ。
【請求項２】　ガラス管バルブと、このバルブの端部に設けられた電子放射性物質を含有する焼結電極と、上記バルブ表面に形成された蛍光体膜と、上記バルブ内に封入されたＸｅを含む希ガスとを具備していることを特徴とする低圧放電ランプ。
【請求項３】　焼結電極は、多孔質状であることを特徴とする請求項１または２に記載の低圧放電ランプ。
【請求項４】　焼結電極は、Ｎｂ、Ｍｏ、Ｒｕ、Ｈｆ、Ｔａ、Ｗ、Ｒｅ、Ｏｓの内から選ばれた少なくとも一種の高融点金属と、Ｍｇ、Ａｌ、Ｓｉ、Ｚｒの内から選ばれた少なくとも一種の還元作用を有する金属と、Ｃａ、Ｓｒ、Ｂａ、Ｒａの内から選ばれた少なくとも一種のアルカリ土類金属の酸化物とを有することを特徴とする請求項１ないし請求項３のいずれか一に記載の低圧放電ランプ。
【請求項５】　焼結電極は、Ｎｂ、Ｍｏ、Ｒｕ、Ｈｆ、Ｔａ、Ｗ、Ｒｅ、Ｏｓの内から選ばれた少なくとも一種の高融点金属と、Ｍｇ、Ａｌ、Ｓｉ、Ｚｒの内から選ばれた少なくとも一種の還元作用を有する金属と、Ｃａ、Ｓｒ、Ｂａ、Ｒａの内から選ばれた少なくとも一種のアルカリ土類金属の酸化物と、セラミック形成材料とを有することを特徴とする請求項１ないし請求項３のいずれか一に記載の低圧放電ランプ。
【請求項６】　器具本体と、この器具本体に設けられた請求項１ないし請求項５のいずれか一に記載の低圧放電ランプと、この低圧放電ランプに接続された点灯回路装置とを具備していることを特徴とする照明装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明はパソコンなどの情報機器やテレビなどの表示機器あるいは照明器具などにおいて使用される低圧放電ランプおよびこのランプを装着した上記情報機器や表示機器のバックライト装置ならびに照明器具などの照明装置に関する。
【０００２】
【従来の技術】低圧放電ランプたとえば蛍光ランプの構成は、内面に蛍光体被膜が形成されたガラス管バルブの両端に放電電極が設けられるとともに、このバルブ内には放電を容易にし所定の発光をさせるための放電媒体としてアルゴンなどの希ガスと適量の水銀とが封入されている。
【０００３】そして、この蛍光ランプは電極に電流を流してバルブ内に放電を生起させ、紫外線を発生してバルブ内面に塗布されている蛍光体を励起して、蛍光体の種類によって白色、昼光色、青色、赤色などの所望の色光をランプから放射するようになっている。
【０００４】近年、蛍光ランプは通常の照明用のほか、液晶を組込んだパソコン、ワープロ、電子手帳などの情報機器やテレビなどの表示機器のバックライトとして用いられている。
【０００５】そして、この蛍光ランプは入力が小さく、通常の一般照明用の蛍光ランプに比べ、細径で小形化され低消費電力で、同時に高輝度化、薄型化や小形化、省電力化、長寿命化などの高性能化がすすめられている。
【０００６】一方、これら機器はランプ交換が行われないのが原則で、ランプも機器の寿命に合わせたものが要求されている。このため、バックライト用の小形蛍光ランプは、低消費電力に適合するよう電流と電圧、封入する希ガスの種類や水銀の量などとともに寿命の観点からも最適な電極の設計がなされている。
【０００７】このようにランプを小形化するには、電極部も小形化する必要があり、特性的にはタングステン線を巻回したコイル状フィラメント電極が好ましいが、細径のフィラメントは支持が困難であるとともに振動や衝撃に弱いという問題がある。そこで、たとえばバルブを１０mm以下の細径化した放電ランプではフィラメント電極に代え冷陰極型の電極が多用されている。この冷陰極型の電極は、Ｎｉ板製の平板状、円筒状や、くの字状あるいはＮｉ製の円柱状をなしたものが用いられ、これら電極の表面には、熱電子の放出を高め長期寿命を得るためＢａなどのアルカリ土類金属の酸化物からなる電子放射性物質（エミッタ）が塗布形成されている。そして、電子放射性物質は点灯経過とともに徐々に消耗していき枯渇すると点灯が不可能となり寿命に至る。
【０００８】しかし、上記電極は構成上その表面にのみしか電子放射性物質が保持できないのでその量が十分でなく、また、振動や衝撃などでその一部が電極から剥離し脱落してしまうなどのことがあった。また、最近は小形、高出力化されているので、板状や円筒状などの電極は表面積が小さく、放電が電極全体を包み陰極降下電圧が上昇してランプ電圧が高くなり、発光効率が低下するとともにスパッタリングが激しく電極構成部材の消耗がはやく短寿命となることがある。そして、これらの現象は、情報機器や表示機器のバックライト装置などの薄型化や小形化、省電力化、高輝度化、長寿命化などの高性能化をすすめるうえで障害となっていた。
【０００９】
【発明が解決しようとする課題】本発明は上記問題に鑑みなされたもので、ガラス管バルブ径を細径化しても、所望の発光特性や始動特性が得られる長寿命の低圧放電ランプおよびこのランプを装着したバックライト装置などの照明装置を提供することを目的とする。
【００１０】
【課題を解決するための手段】本発明の請求項１に記載の低圧放電ランプは、ガラス管バルブと、このバルブの

端部に設けられた電子放射性物質を含有する焼結電極と、上記バルブ内に封入された希ガスとを具備していることを特徴とする。

【００１１】電極が焼結体で形成され、電子放射性物質が電極の内部にまで多量保持できる。そして、電子放射性物質はランプの点灯経過とともに表面側から電極内部に向かい徐々に消耗していくので、放電を長期に亘り持続でき、すなわち長寿命化できる。また、電子放射性物質を多量に保持しているので陰極降下電圧が低くなり、ランプ電圧および消費電力の低下がはかれ発光効率および始動特性を向上できる。

【００１２】本発明の請求項２に記載の低圧放電ランプは、ガラス管バルブと、このバルブの端部に設けられた電子放射性物質を含有する焼結電極と、上記バルブ表面に形成された蛍光体膜と、上記バルブ内に封入されたＸｅを含む希ガスとを具備していることを特徴とする。

【００１３】蛍光体を励起して発光させる蛍光ランプなどにおいて、上記請求項１に記載と同様な作用を奏する。

【００１４】また、Ｘｅ（キセノン）を含む希ガスを１５０Ｔｏｒｒ（２０ｋＰａ）以下の圧力封入しており、このＸｅは熱伝導度がＡｒ（アルゴン）などに比べ比較的小さいため電極の保温性がよく、電極の熱損失が少なく、熱電子放出の効率を高くできる。また、電極部材のスパッタリングも抑制できる。なお、封入希ガス中のＸｅ（キセノン）の割合は、６０～１００容量％の範囲であればよい。　なお、Ａｒ（アルゴン）を主体として封入したランプでは電極の保温性が悪く、低電流領域では電極の表面に輝点を維持することが困難で、スパッタリングにより電極部材の消耗が速く短寿命になることがある。

【００１５】本発明の請求項３に記載の低圧放電ランプは、焼結電極が、多孔質状であることを特徴とする。

【００１６】電極が、金属および電子放射性物質（アルカリ土類金属の酸化物）の焼結体で形成され、多孔質状で電子放射性物質が電極の内部にまで多量保持できる。そして、上記請求項１に記載と同様な作用を奏する。

【００１７】本発明の請求項４に記載の低圧放電ランプは、焼結電極が、Ｎｂ、Ｍｏ、Ｒｕ、Ｈｆ、Ｔａ、Ｗ、Ｒｅ、Ｏｓの内から選ばれた少なくとも一種の高融点金属と、Ｍｇ、Ａｌ、Ｓｉ、Ｚｒの内から選ばれた少なくとも一種の還元作用を有する金属と、Ｃａ、Ｓｒ、Ｂａ、Ｒａの内から選ばれた少なくとも一種のアルカリ土類金属の酸化物とを有することを特徴とする。

【００１８】焼結電極中の高融点金属は、電極の基体材料で、電極の蒸発抑制とスパッタリングに対する耐性を持続するため用いられ、また、還元作用を有する金属は、電子放射作用を有するアルカリ土類金属が酸化物であるため、これを解離して電子放射性物質の活性化を促するため混合されている。

【００１９】なお、高融点金属、還元作用を有する金属およびアルカリ土類金属の酸化物はそれぞれの群から選ばれた一種ないし複数種を含むものであればよい。

【００２０】本発明の請求項５に記載の低圧放電ランプは、焼結電極が、Ｎｂ、Ｍｏ、Ｒｕ、Ｈｆ、Ｔａ、Ｗ、Ｒｅ、Ｏｓの内から選ばれた少なくとも一種の高融点金属と、Ｍｇ、Ａｌ、Ｓｉ、Ｚｒの内から選ばれた少なくとも一種の還元作用を有する金属と、Ｃａ、Ｓｒ、Ｂａ、Ｒａの内から選ばれた少なくとも一種のアルカリ土類金属の酸化物と、セラミック形成材料とを有することを特徴とする請求項１または２に記載の低圧放電ランプ。

【００２１】焼結電極は、上記請求項４に記載の材料に加えＡｌ、Ｓｉ、Ｍｇ、Ｂｅ、Ｙ、Ｈｆ、Ｚｒ、Ｔｈ、などの酸化物などから選ばれた少なくとも一種のセラミック形成材料を混合し焼結してセラミック化とすることによって、電極自身の熱伝導率を下げて、保温性を高める作用を奏する。

【００２２】なお、高融点金属、還元作用を有する金属、アルカリ土類金属の酸化物およびセラミック形成材料はそれぞれの群から選ばれた一種ないし複数種を含むものであればよい。

【００２３】本発明の請求項６に記載の照明装置は、器具本体と、この器具本体に設けられた請求項１ないし請求項５のいずれか一に記載の低圧放電ランプと、この放電ランプに接続された点灯回路装置とを具備していることを特徴とする。

【００２４】この照明装置は、上記請求項１ないし請求項５に記載の作用を有する低圧放電ランプを備えているので、バックライトなど種々の機器のさらにの長寿命化がはかれる。

【００２５】

【発明の実施の形態】以下、本発明の実施の形態を図１ないし図３を参照して説明する。図１は低圧放電ランプの一部切欠正面図、図２は図１のランプの端部の拡大縦断面図、図３は図１の矢視Ａ－Ａ線に沿って断面した横断面図である。

【００２６】この低圧放電ランプは、たとえば直管形のランプ電流が３０ｍＡ以下の蛍光ランプＬで、軟質ガラスや硬質ガラスからなる管状のバルブ１は外径が約４．８ｍｍ、肉厚が約０．５ｍｍ、全長が約４００ｍｍで、両端のそれぞれの封止部２、２にはマウント３を構成するリード線４が気密に封着されている。

【００２７】このマウント３はバルブ１内においてリード線４の先端に金属および電子放射性物質（エミッタ）を混合焼結した円柱状の焼結電極５およびこの焼結電極５を収容保持したＮｉ（ニッケル）製のパイプ６を備えている。そして、このパイプ６の一端側は縮径されて上記リード線４の先端を挿入して溶接固定し、他端側は一部を内方に折曲げた係止片６ａ，６ａによって焼結電極

５の脱落を防いでいる。　また、この焼結電極５は、Ｔａ（タンタル）からなる高融点金属と、Ｚｒ（ジルコニウム）からなる還元作用を有する金属と、電子放射性物質としてＢａ（バリウム）からなるアルカリ土類金属とを混合して焼結したものからなる。

【００２８】なお、この焼結電極５の組成材料は、高融点金属群としてＮｂ（ニオブ）、Ｍｏ（モリブデン）、Ｒｕ（ルテニウム）、Ｈｆ（ハフニウム）、Ｔａ（タンタル）、Ｗ（タングステン）、Ｒｅ（レニウム）、Ｏｓ（オスミウム）などが、また、還元作用を有する金属群としてＭｇ（マグネシウム），Ａｌ（アルミニウム），Ｓｉ（ケイ素）、Ｚｒ（ジルコニウム）などが、また、電子放射性物質（エミッタ）としてアルカリ土類金属群のＣａ（カルシウム）、Ｓｒ（ストロンチウム）、Ｂａ（バリウム）、Ｒａ（ラジウム）などがあり、これら各群の中から少なくとも１種を選び混合構成すればよい。

【００２９】また、上記バルブ１の内壁面にはたとえば青色、緑色、赤色に発光領域を有する蛍光体を混合した３波長形の蛍光体被膜７が形成され、バルブ１の内部にはＸｅ（キセノン）約９０容積％－Ｈｅ（ヘリウム）約１０容積％の混合希ガスが約１００Ｔｏｒｒ封入してある。

【００３０】このような構成の蛍光ランプＬを、通常の高周波点灯回路に接続し通電すると、焼結電極５の先端表面に混在している電子放射性物質が電子放射をして両電極５、５間に放電を起こす。そして、Ｘｅなどの希ガスが発光し紫外線を発し、この紫外線をバルブ１内壁面の蛍光体被膜７が受け励起して所定の可視光をバルブ１外に放射する。

【００３１】この蛍光ランプＬは、上記組成の焼結電極５を備え、この電極５は金属および電子放射性物質の粉体を混合し加圧成形して熱処理されたもので多数の空隙を有する多孔質状で、その表面および電極５中にＢａの酸化物からなる電子放射性物質を多量に混在している。そして、電子放射性物質の消耗は電極表面に存在しているものに限らず、電極表面側に位置するものが無くなっても電極内部から供給される結果、放電を長期に亘り持続でき、すなわち長寿命化できる。

【００３２】したがって、電子放射性物質を含有している焼結電極５は、電子放射性物質の消耗がランプＬの点灯経過とともに電極５の表面側から内部へと徐々に移行し、しかも電子放射性物質を多量に保持しているので陰極降下電圧が低くなり、ランプ電圧および消費電力の低下がはかれ発光効率および始動特性を向上できる。また、電極５の陰極降下電圧の低減が持続されることとなり大電流領域の使用においても高効率、長寿命化した蛍光ランプＬが得られた。また、電極５部材のスパッタリングが少なくなり長寿命化の一助となった。

【００３３】また、この蛍光ランプＬは、バルブ１内にＸｅを含む希ガスを封入したことにより、ランプＬ点灯中の電極５の保温性が高められた結果、電極５での熱損失が少なく、かつ、電極５からの熱電子放出の効率を高めることができ、電極５部材のスパッタリングの抑制も可能になった。

【００３４】また、本発明は上記実施の形態に記載した組成材料からなる焼結電極５に限らず、下記のものであってもよい。

【００３５】上記実施の形態に記載した焼結電極の組成材料に、すなわち、Ｎｂ、Ｍｏ、Ｒｕ、Ｈｆ、Ｔａ、Ｗ、Ｒｅ、Ｏｓなどの内から選ばれた少なくとも１種の高融点金属と、Ｍｇ、Ａｌ、Ｓｉ、Ｚｒなどの内から選ばれた少なくとも１種の還元作用を有する金属と、Ｃａ、Ｓｒ、Ｂａ、Ｒａなどの内から選ばれた少なくとも１種のアルカリ土類金属の酸化物（電子放射性物質）に、さらに、Ａｌ（アルミニウム）、Ｓｉ（ケイ素）、Ｍｇ（マグネシウム）、Ｂｅ（ベリリウム）、Ｙ（イットリウム）、Ｈｆ（ハフニウム）、Ｚｒ（ジルコニウム）やＴｈ（トリウム）などの酸化物などの内から選ばれた少なくとも一種のセラミック形成材料とを加え、これらを混合焼結して形成したセラミック系のものであってもよい。このようにセラミック化した電極も、上記実施の形態に記載したと同様な作用効果を呈する。

【００３６】そして、上記図１に示す蛍光ランプＬは、たとえば図４に示すようにバックライト装置８の光源として組込みまれ使用される。この図４において８１はランプＬ，Ｌ，…を装着した反射鏡、８２は反射鏡８１の開口部に載置された光拡散板で、パソコンやテレビなどの液晶表示装置のバックライト装置として、あるいは所定のディスプレイ装置が形成された表示板のバックライト装置として使用され、ランプＬが高効率となるところから、これら装置の高効率化がはかれるとともに小形化も可能である。

【００３７】また、通常の照明装置としても使用できるものである。

【００３８】なお、本発明は上記実施の形態に限定されない。たとえば、放電ランプは蛍光ランプに限らず、希ガス発光によるランプなど他の細管形（放電路が小断面）の低圧放電ランプに適用できる。また、その用途もバックライト装置用に限らず、照明用はもとより殺菌などの紫外線放射用のランプなどにも適用できる。

【００３９】また、焼結電極の支持構造も実施の形態に限らず、パイプなどを用いずに電極とリード線とを直接に接続するようにしてもよい。

【００４０】また、バルブの材質は鉛ガラスやソーダライムガラスなどの軟質ガラスあるいはアルミノシリケートガラスなどの硬質ガラスであってもよく、その形状は直管形状のものに限らず、Ｕ字形状やＷ字形状などの屈曲したバルブあるいは直管状のものを複数本接続して放電路を直列的に形成したバルブなどであってもよい。さらに、ランプに封入する希ガスはＸｅ（キセノン）－Ｈ

ｅ（ヘリウム）に限らずＸｅ（キセノン）にＡｒ（アルゴン）、Ｎｅ（ネオン）やＫｒ（クリプトン）などを混合したガスであってもよく、これもランプ特性に合わせ、混合比や封入圧を適宜決めればよい。

【００４１】

【発明の効果】本発明の請求項１ないし請求項５の記載によれば、発光効率の向上および長寿命化がはかれた低圧放電ランプを提供することができる。

【００４２】本発明の請求項６の記載によれば、上記請求項１ないし請求項５に記載と同様な効果を奏する低圧放電ランプを備えているので、バックライト装置など種々の機器の高効率化と長寿命化がはかれる照明装置を提供することができる。

【図面の簡単な説明】

【図１】本発明の低圧放電ランプの実施の形態を示す一部切欠正面図である。

【図２】図１のランプの端部の拡大縦断面図である。

【図３】図１の矢視Ａ－Ａ線に沿って断面した横断面図である。

【図４】本発明に係るバックライト装置の実施の形態を示す、分解斜視図である。

【符号の説明】

Ｌ：蛍光ランプ（低圧放電ランプ）

１：ガラス管バルブ

２：封止部

３：マウント

４：リード線

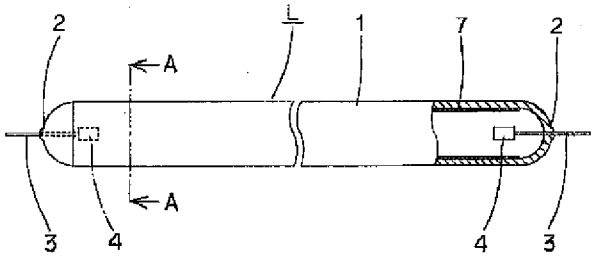
５：焼結電極

８：バックライト装置（照明装置）

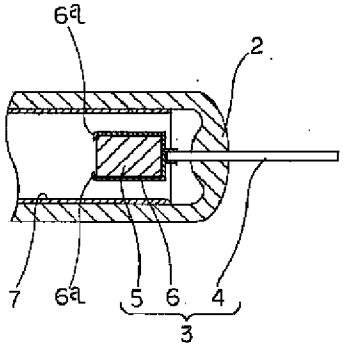
８１：反射鏡

８２：光拡散板

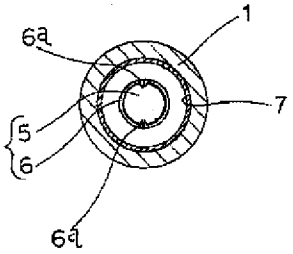
【図１】



【図２】



【図３】



【図４】